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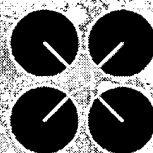
# XACCT Technologies

IIR / Amsterdam / IP  
Network Billing / 16 Feb  
2000

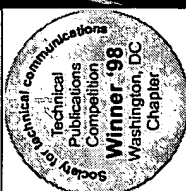
Billing For Content -  
Workshop

Limor Schweitzer  
CTO

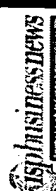
[limor@xacct.com](mailto:limor@xacct.com)



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MOST INNOVATIVE  
BILLING PRODUCT



# (1/3) Existing and Upcoming Data Pricing Models

## Chapter 2 (ATM, F/R) Pricing Models

- Permanent virtual circuits (PVCs). Innovative billing approaches are required to offer new revenue opportunities for more transient switched virtual circuits (SVCs). Rating elements to enable innovative billing include:
  - *Time-based access*
    - Metered by SVC duration, time-of-day, and time-of-week
  - *Usage-sensitive charges for both PVCs and SVCs*
    - Based on data transmitted or received, peak bit rate, call rate, and excess volume surcharges
  - *QoS-based fees*
    - Based on service-specific parameters such as ATM traffic rates, available bit rate [ABR], constant bit rate [CBR], variable bit rate [VBR], and unspecified bit rate [UBR]) or Frame Relay committed information rate (CIR), and prioritization by access port or VC.



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## Chapter 3 (IP) Pricing Models

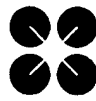
- ***Time-based IP***
  - Metered by flow duration, time-of-day, and time-of-week
- ***Usage-sensitive IP***
  - Based on peak bit rate, packet or octet counts, excess usage surcharges
- ***Distance Sensitive***
  - Where price takes into account Destination and Distance (by associating IP and AS addresses to location, geography and remote carriers are identified)
- ***Application and CoS-based IP***
  - Where tariffs depend upon application type (VoIP requires higher priority than email), IP Header - TOS bits, Source-based routing priorities, effective QoS measurements



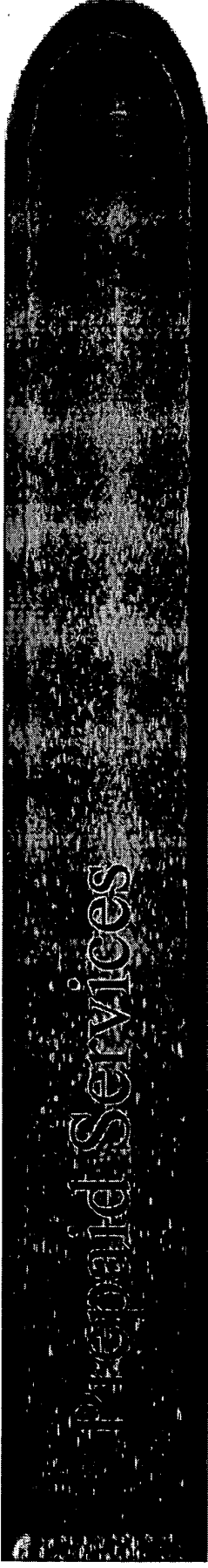
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## Internet Access Pricing Models

- ***Flat-rate "all-you-can-eat" Internet access***
  - A necessary baseline in today's market
- ***Time-based access***
  - Metered by call duration, time-of-day, and time-of-week
- ***Usage-sensitive access***
  - Based on octets transmitted or received, optionally combined with excess usage surcharges
- ***Destination-, distance-, and carrier-based access***
  - Where tariffs rely on called and calling numbers
- ***CoS-based access fees***
  - Based on speed and user/traffic priority



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- Current implementations of prepaid
  - Time based services
  - VoIP minutes
  - Content based services (books, music..)
- Next Generation Prepaid Services
  - Volume
  - QoS \* Volume
  - User selectable Service provider and QoS

## GP-RS (3G Mobile) Pricing Model

- **Time, Volume-based**
  - per minute - voice/video
  - by bytes or throughput
  - Geography, Roaming
- **Transaction-based**
  - WAP/Web transactions
  - Content/Location-based-payment



# Multi-Source Multi-Layer™ Pricing Model

- Time-based
  - per minute
  - Time of day or Time or Week (Peak/Off Peak)
- Application-or Application-class based
  - Charged on the type of application being used
  - Charge based on service level or satisfaction levels for premium services (QoS, CoS)
  - Security level
- Transaction-based
  - Charged on the number of transactions used
  - Content-based- micro-payment
  - Movie, Games
- Destination/distance-based
  - Charge based on geography
  - Intra-Inter domain - in or outside the network

## Examples of new value-added services

- Application rental
  - ERP (e-business.bt.com), hotmail.com, presentation.net
  - Messaging (voicemail, fax, SMS - [e/j]fax.com)
- IP Music and Video Broadcast
  - Radio (spinner.com, mp3.com), Video (broadcast.com)
- Network Services
  - Interactive Voice/Video over IP ; long-distance gateways, UNPBX; IN/IP services (pac.com); PSTN-Internet redirect
  - Dynamic Service Provider Selection
- Clearinghouse Services
  - Single ISP bill for various types of micro-transactions

## (2/3) IP Mediation Challenges

## Data Collection Challenges

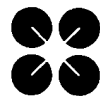
Potentially 100K's events / second  
hundreds of distributed elements

Data must be collected and aggregated  
in real-time before sending to DB

Hybrid value-chain of content and data

No accounting Standards

No permanent user identification  
elements are not SLA "aware"



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## Provisioning Challenges

Network Devices and most Applications  
Servers are not Customer-Aware

Network Management Systems  
Customer-centric

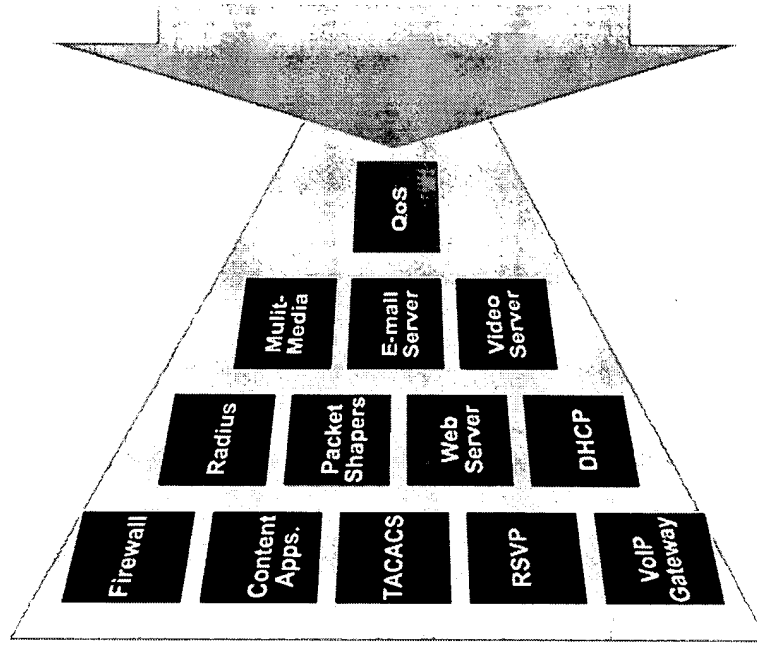
Customer Information replicated in  
each system, accessed differently

Transaction concepts missing  
commit, resource locking, roll-back

The promise of Directory Enabled  
Networking is in the far horizon

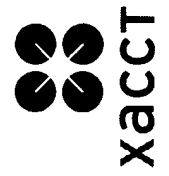
# Creating Network Billing Records

# Provisioning The IP Network

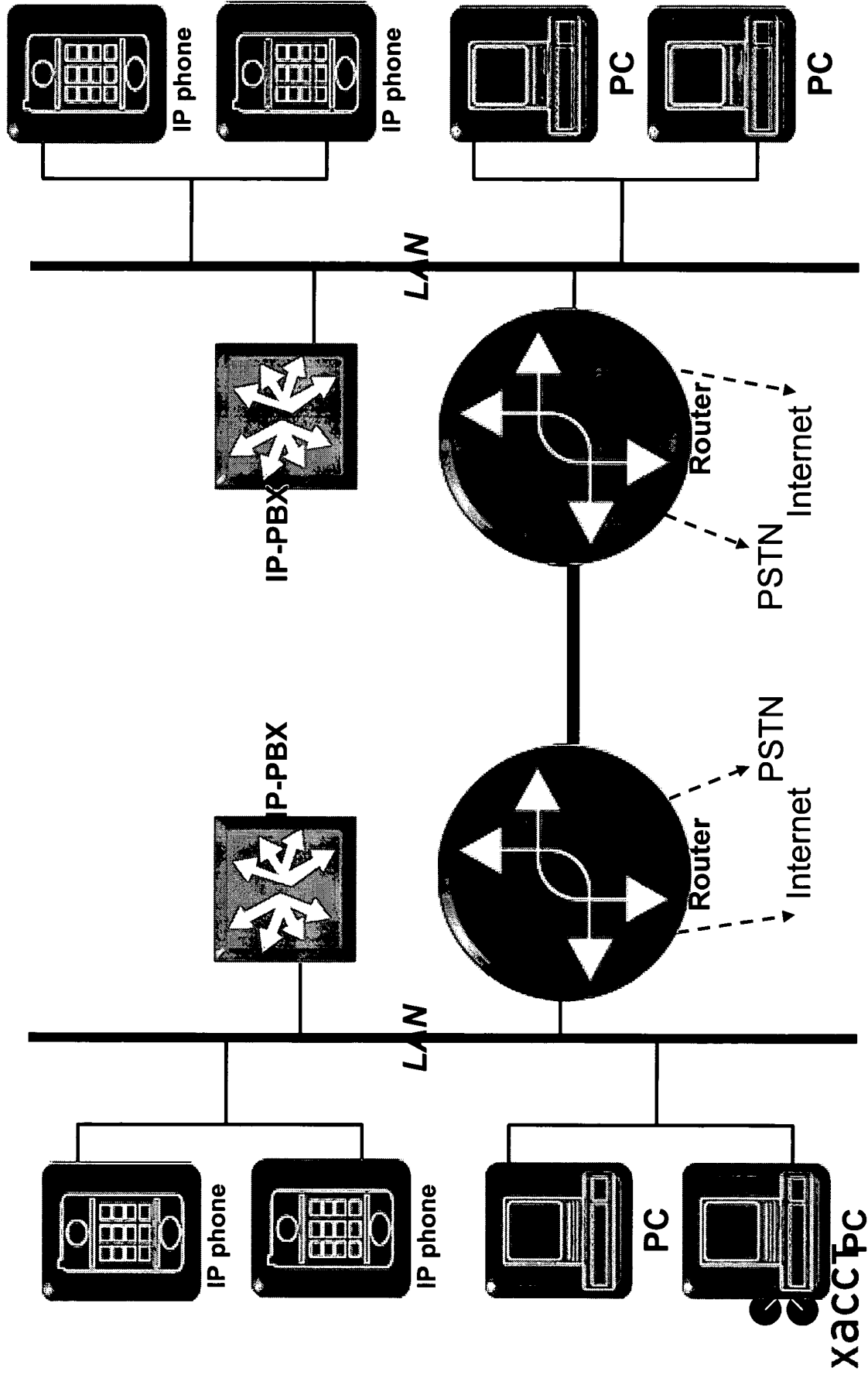


- ❖ Get service order
- ❖ Break to commands
- ❖ Map to server
- ❖ Send to server
- ❖ Send confirmation

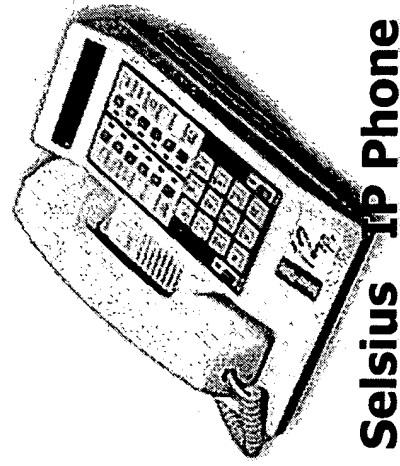
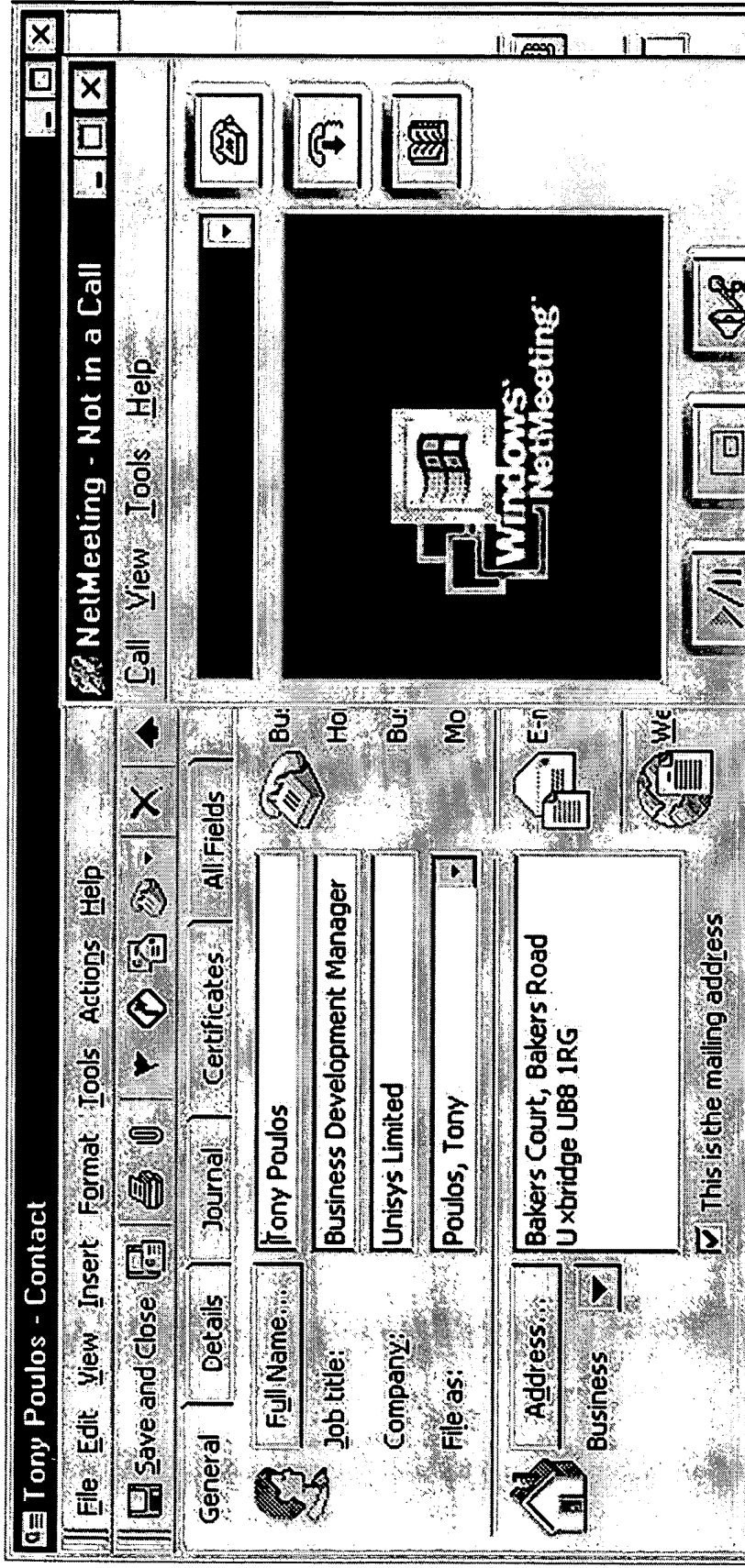
**Customer  
&  
Billing**



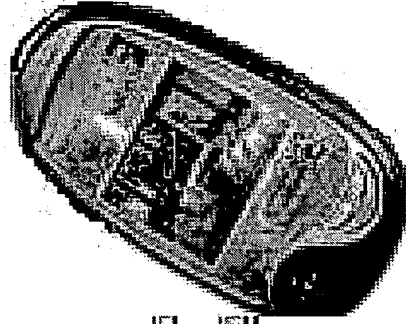
# Voice over IP Inter-office architecture



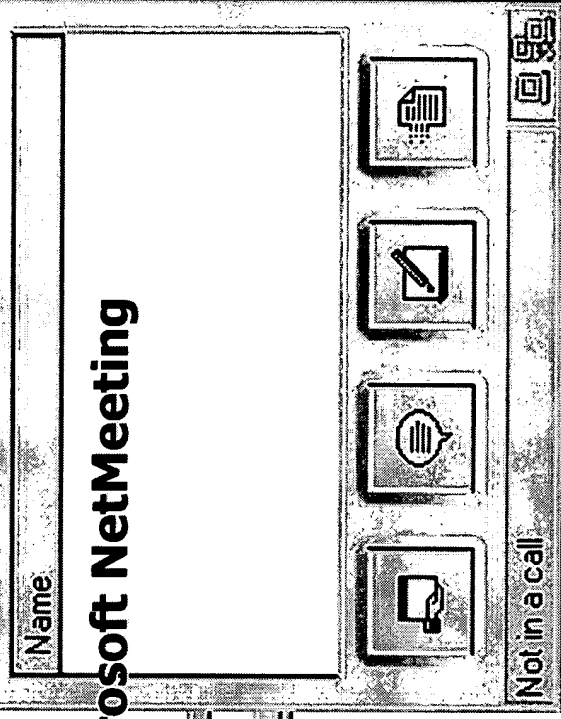




**Selsius IP Phone**

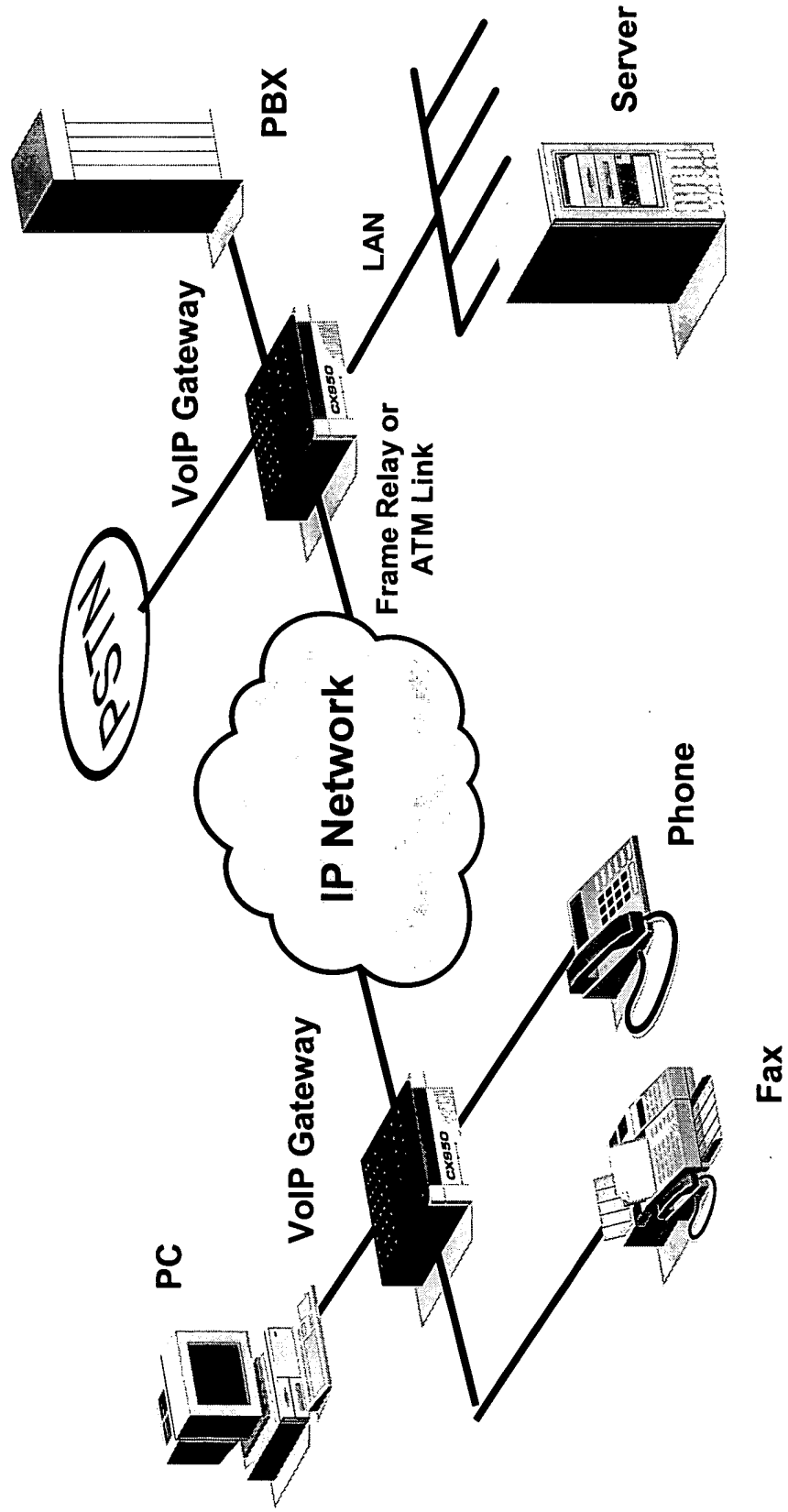


**Nokia Mobile Video Phone**



**Microsoft NetMeeting**

# (Simplified) VoIP Topology

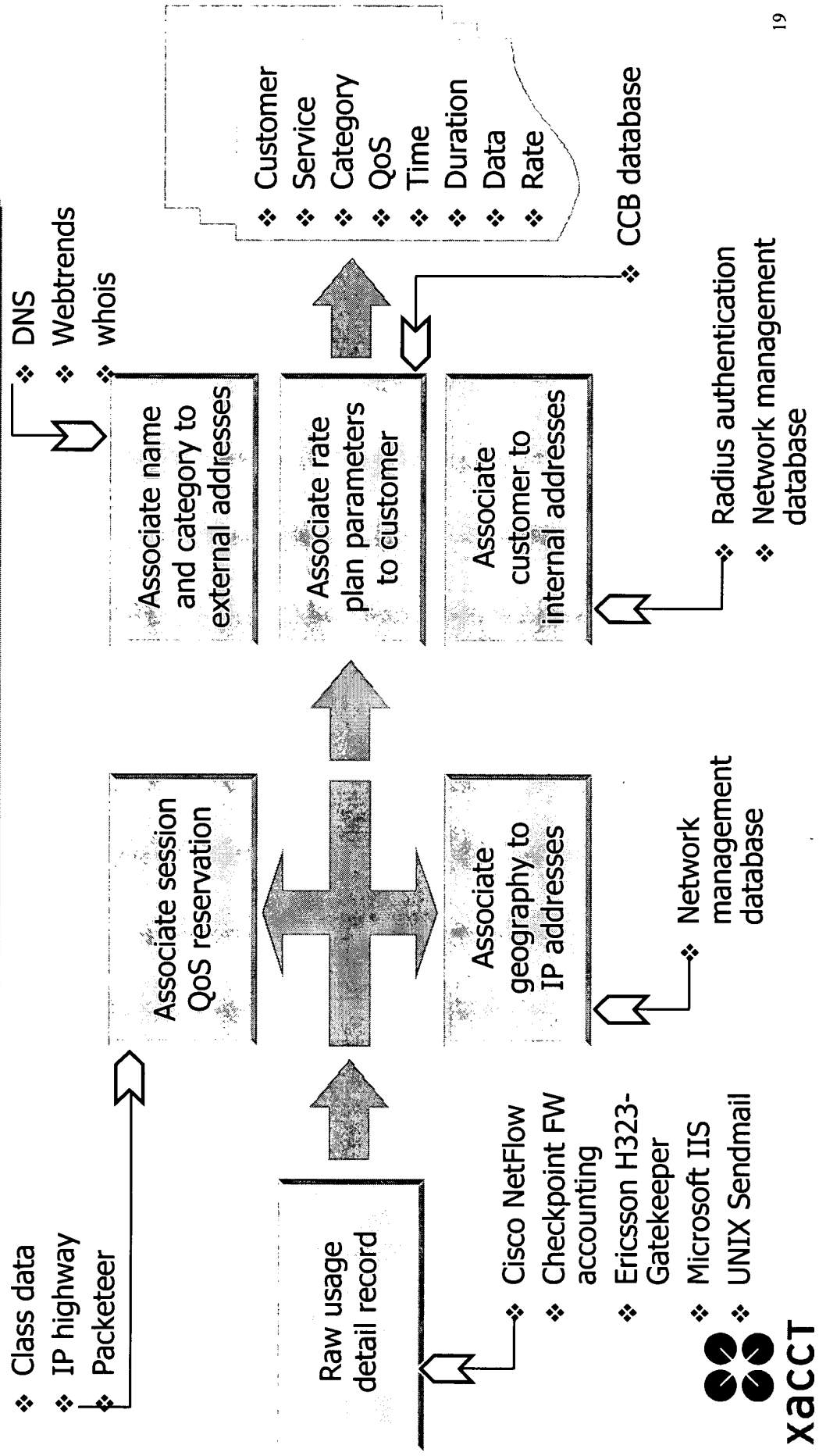


# CISCO VoIP Gateway MIB Params

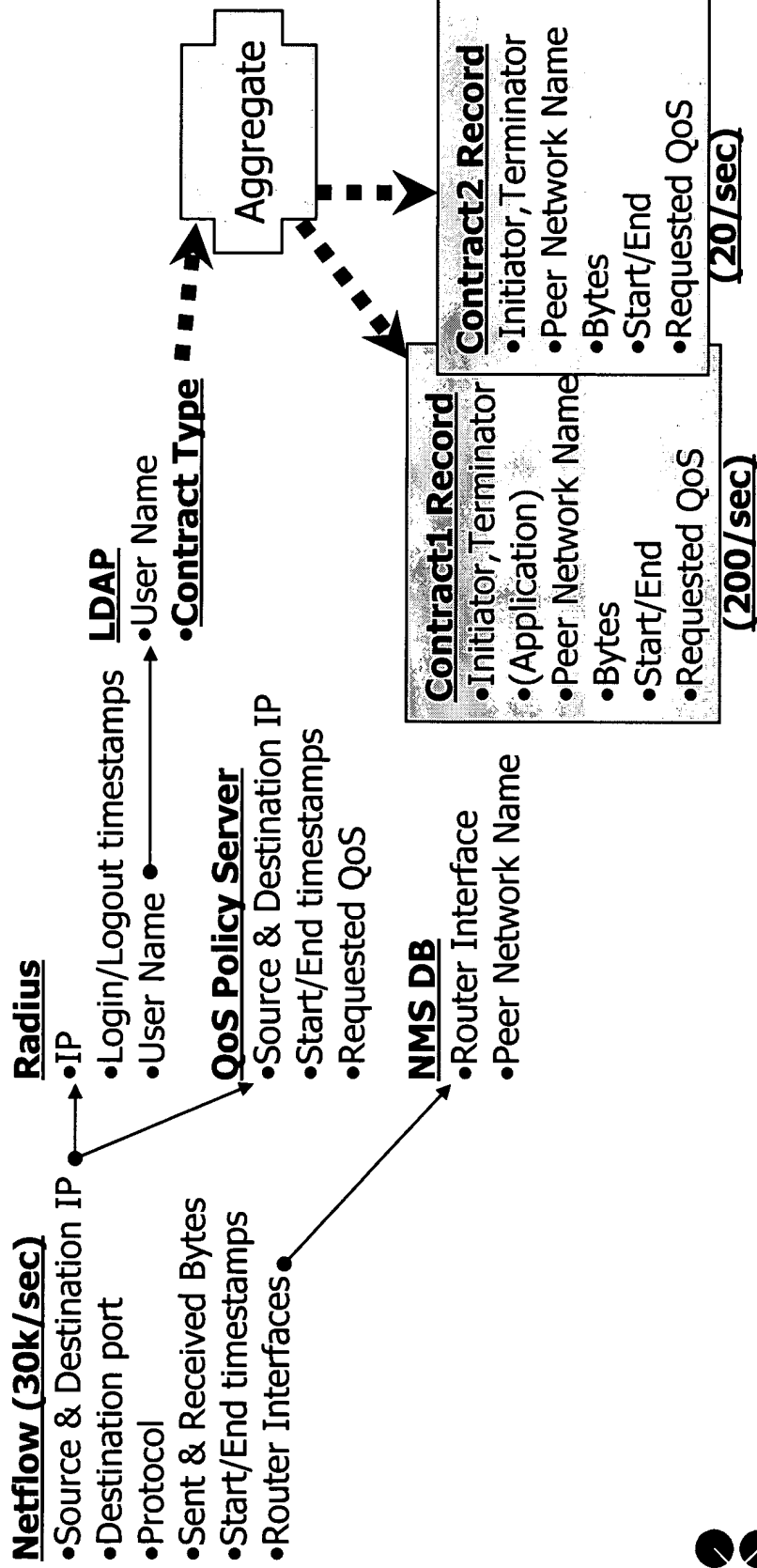
• Connection ID	• Sent / Received / Total	• VoIP Physical Interface Index
• Origin IP address	• Packets	• Timestamp
• Calling Number	• Sent / Received / Total	• Telephony Dial Peer ID
• Called Number	• Bytes	• Telephony Logical Interface Index
• Setup Time	• Transmit Path Open Duration	• VoIP Logical Interface Index
• Connect Time	• Voice Duration	• Gap Filled With Prediction
• Disconnect Time	• Fax Duration	• Hi Water Playout Delay
• Disconnect Cause	• Codex Rate	• Low Water Playout Delay
• Disconnect Description	• Average Noise Level	
• Information Type (e.g. speech)	• Average ACOM Level	<b>Limitations of MIB:</b>
• Duration Playout Receive On-Time	• Session Target	– 500 entries
• Selected QoS	• Charged Units	– rolling table
• Round Trip Delay	• Device Type	– events can be lost
• Receive Delay	• Remote IP Address	<b>Solution</b>
• VAD Enable	• Remote UDP	– Merge info with Radius accounting (reliably delivered but contain less metrics)
• CPIF (Impairment Factor)	• Gap Filled With Silence	

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# Generating IP Billable Records



# Contract-Based Data Enhancement



# Aggregated NetFlow and VoIP VPNs

NetFlow records

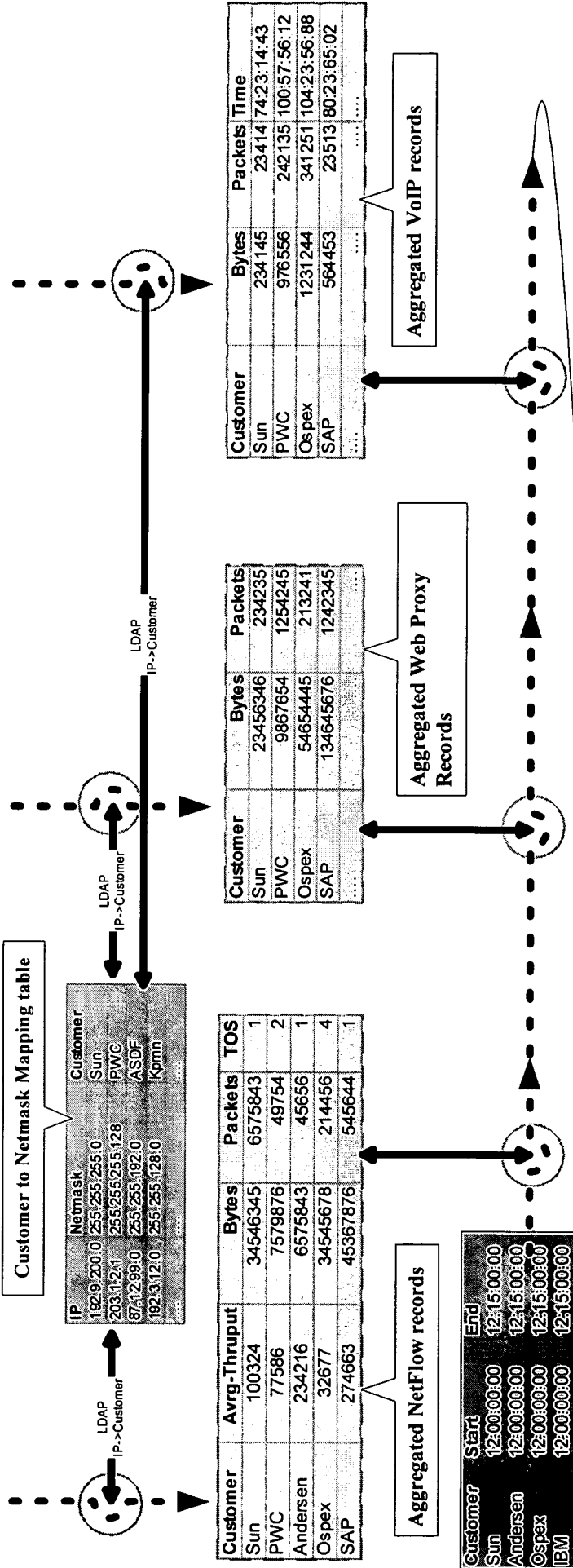
SRC	DST	Start	End	Bytes	Packets	TOS
124.132.2.54	97.34.123.45	11:01:23.23	11:01:32.01	234564	3452	2
203.1.2.1	200.32.145.5	10:55:42.65	11:02:2.76	6456723	66453	1
87.12.99.34	121.4.35.4	10:53:87.34	10:59:28.34	565427	10675	1
192.3.12.45	154.12.32.65	11:00:01.23	11:55:32.75	457345	54768	4

Web Proxy records

SRC	DST	Start	End	Bytes	URL
124.132.2.54	97.34.123.45	11:01:23.23	11:01:32.01	234564	http://www.microsoft.com/index.html
203.1.2.1	200.32.145.5	10:55:42.65	11:02:2.76	6456723	ftp://ftp.sunsite.unc.edu/pub/gnu/gcc.tar.gz
87.12.99.34	121.4.35.4	10:53:87.34	10:59:28.34	565427	http://www.xrated.org/welcome.html
192.3.12.45	154.12.32.65	11:00:01.23	11:55:32.75	457345	https://www.bankamerica.com/stocks/ab.gif

VoIP Records

SRC	DST	Start	End	Bytes	Packets	QoS
124.132.2.54	97.34.123.45	11:01:23.23	11:01:32.01	234564	3452	1
203.1.2.1	200.32.145.5	10:55:42.65	11:02:2.76	6456723	66453	2
87.12.99.34	121.4.35.4	10:53:87.34	10:59:28.34	565427	10675	1
192.3.12.45	154.12.32.65	11:00:01.23	11:55:32.75	457345	54768	2



Customer to Netmask Mapping table

IP	Netmask	Customer
192.9.200.0	255.255.255.0	Sun
203.1.2.1	255.255.255.128	PWC
87.12.99.0	255.255.192.0	ASDF
192.3.12.0	255.255.128.0	Komn

Customer	Avg-Thruput	Bytes	Packets	TOS
Sun	100324	34546345	6575843	1
PWC	77586	7579876	49754	2
Andersen	234216	6575843	45656	1
Ospex	32677	34545678	214456	4
SAP	274663	45367876	545644	1

Aggregated NetFlow records

Customer	Start	End
Sun	12:00:00:00	12:15:00:00
Andersen	12:00:00:00	12:15:00:00
Ospex	12:00:00:00	12:15:00:00
IBM	12:00:00:00	12:15:00:00

Aggregated Web Proxy Records

Customer	Bytes	Packets
Sun	23456346	234235
PWC	9867654	1254245
Ospex	54654445	213241
SAP	134645676	1242345

Aggregated VoIP records

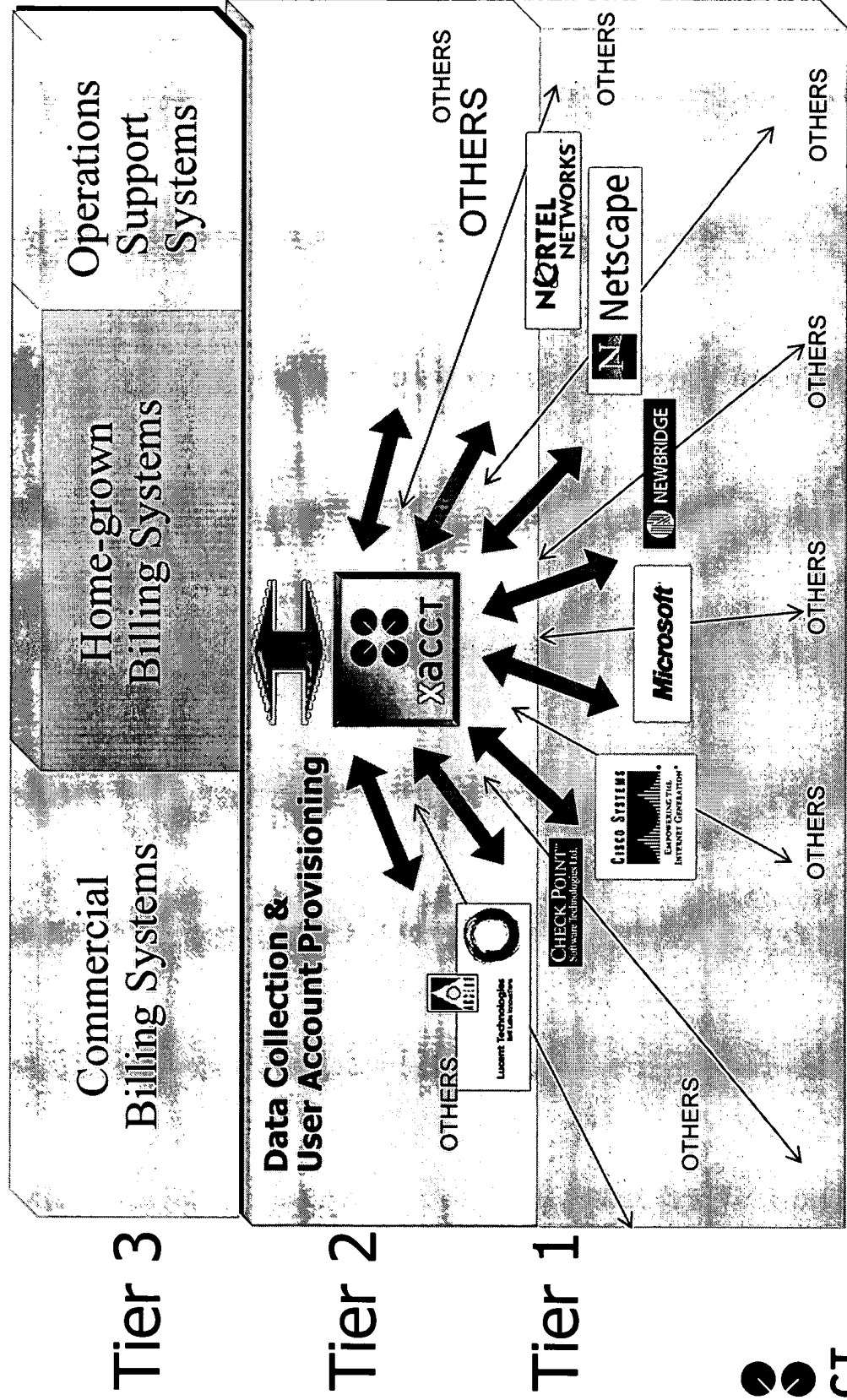
Customer	Bytes	Packets	Time
Sun	234145	23414	74:23:14:43
PWC	976556	242135	100:57:56:12
Ospex	1231244	341251	104:23:56:88
SAP	564453	23513	80:23:65:02

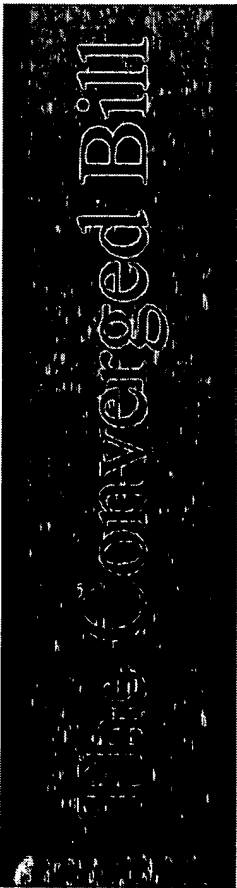
A Trigger record is sent for every customer every 15 mins

Billing records - record total resource consumption for all customers every 15 mins

Customer	SRC	DST	Start	End	Bytes	Packets	TOS	Proxy Bytes	Proxy Packets	VoIP Bytes	VoIP Packets	VoIP Time
Sun	124.132.2.54	97.34.123.45	11:01:23.23	11:01:32.01	234564	3452	2	23456346	234235	234145	23414	74:23:14:43
PWC	203.1.2.1	200.32.145.5	10:55:42.65	11:02:2.76	6456723	66453	1	9867654	1254245	976556	242135	100:57:56:12
Ospex	87.12.99.34	121.4.35.4	10:53:87.34	10:59:28.34	565427	10675	1	54654445	213241	1231244	341251	104:23:56:88
SAP	192.3.12.45	154.12.32.65	11:00:01.23	11:55:32.75	457345	54768	4	134645676	1242345	564453	23513	80:23:65:02

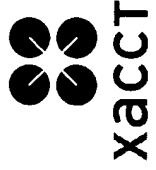
# Architecture For The New Public Network





Consolidated bill for all (IP) services:

- Access
- VoIP
- Video Conferencing
- VPN
- IP Fax
- On-demand Movies,
- Content services
- Undelivered QoS discount



ATE TOTAL INTERNET COMMUNICATIONS

Bill date	Invoice number	Account number	Payment due	Amount due	Amount Enclosed
11/18/1999	1114236998	100-145-887-1227	12/18/1999	\$182.31	

BILL TO: John Smith  
1234 Silicon Road  
Sunnyvale, CA 95058

ABC Company Inc.  
8888 Exterior Way  
Suite 200  
Santa Clara, CA 95051

Account Summary	
Balances Forward	Total
Previous Balance	\$235.76
Payment Received	Payment Received THANK YOU -\$158.76
Current Balance	\$197.53
Total Balance Due	
\$197.53	

Internet Access Event Summary	
128K bps Monthly access fee	\$39.95
Wireless Data Services	\$19.34
Total	
\$59.29	

Internet Telephony Event Summary	
Local VoIP	\$8.11
Long Distance U.S.	\$32.44
International VoIP	\$22.37
Total	
\$63.32	

Video Conferencing Event Summary	
Long Distance (Gold: 30 frames per second)	\$48.93
Long Distance (Economy: 10 frames per second)	\$12.51
Intra-domain connection discount	(\$16.48)
Dropped call discount	(\$6.12)
Total	
\$38.84	

Security, VPN Services Summary	
Firewall (secured connection)	\$14.98
Secured file transfers (total: 532 Mbytes)	\$9.15
Encryption services (39 Mbytes)	\$2.14
Total	
\$26.27	

Other Transactions and Services Summary	
Email Service	\$2.50
IP Fax	\$3.25
On-Demand Movies	\$28.00
Network Games	\$9.68
Financial Data	\$6.32
Total	
\$49.75	

Other Discounts / Special Promotions	
Off-peak Hour Discount	(\$27.31)
Unavailable Quality of Service	(\$12.63)
Total	
(\$39.94)	



## (3/3) Pricing IP QoS

# QoS - User Experience Quantified

Service \ QoS	Gold/High	Silver/Medium	Bronze/Low
Web Browsing	Incoming > 6 KB/s, Latency < 500 ms	Incoming <= 6 KB/s OR Latency < 800 ms	Incoming <= 2 KB/s OR Latency >= 800 ms
File transfer	Bandwidth > 20 KB/s	Bandwidth <= 20 KB/s	Bandwidth <= 5 KB/s
e-mail	Bandwidth > 100 KB/s	Bandwidth <= 100 KB/s	Bandwidth <= 2 KB/s
VoIP	Bi-directional > 5 KB/s, Packet Loss < 5%, Latency < 300 ms	Bi-directional <= 5 KB/s OR Packet Loss <= 25% OR Latency < 700 ms	Bi-directional <= 2 KB/s OR Packet Loss > 25% OR Latency >= 700 ms
Video Conferencing	Bi-directional > 48 KB/s, Packet Loss < 5%, Latency < 300 ms	Bi-directional <= 48 KB/s OR Packet Loss <= 25% OR Latency < 500 ms	Bi-directional <= 4 KB/s OR Packet Loss > 25% OR Latency >= 500 ms



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# Building Model for IP QoS

“Tolerable” QoS requirements for IP services			
Application	Latency (in/out)	Throughput (in/out)	Jitter
E-mail	5 sec	8/1 Kbps	High
Web Browsing	1/1 sec	64/1 Kbps	High
FTP	1/1 sec	64/1 Kbps	High
Streaming Audio	500/200 ms	8/1 Kbps	High
Streaming Video	500/200 ms	32/1 Kbps	High
Audio Conference	50/50 ms	16/16 Kbps	Low

### Classical Data Transfer Price Model

- Price  $\sim$  Distance
- Price  $\sim$  Bandwidth
- Price  $\sim$  1/Latency
- Price  $\sim$  Time
- Price  $\sim$  1/Line-Asymmetry

Price ~ Distance  
Price ~ Bandwidth

Price  $\sim$  Bandwidth  
Price  $\sim$  1/Latency

Price  $\sim 1/\text{Latency}$   
Price  $\sim \text{Time}$

Price  $\sim$  Time  
Price  $\sim 1/\text{Line}$

# Price $\sim 1/\text{Line-Asymmetry}$

Application	QoS		Cost					Off-peak discount	Bad QoS discount
	Bandwidth	Latency	Directional	Local	Long Distance	International	Inter-Carrier		
IP Video	High	Low	Bi	10¢/min	20¢/min	30¢/min	40¢/min	10%	10%
IP Voice	Low	Low	Bi	2¢/min	5¢/min	10¢/min	15¢/min	10%	15%
Access to Information-server	High	High	Uni	1¢/access + 3¢/megabyte	1¢/access + 6¢/megabyte	1¢/access + 8¢/megabyte	2¢/access + 10¢/megabyte	20%	5%
	Low	High	Bi	1¢/access + 1¢/megabyte	1¢/access + 3¢/megabyte	1¢/access + 3¢/megabyte	1¢/access + 3¢/megabyte	30%	0%

# Usage-based Contracts

Name	Description	Cost
Standard	Unlimited 56Kbps modem Internet access (no guarantees for QoS, ie: slow)	20\$/month, 20Gb + 90hr limit
Total Corporate	Special package for corporate with at least 2 disparate offices. Including T1 link, VPN, 70hours IP telephony, minimum 64Kbps transfer rate between offices. Unlimited web during working hours. SAP transaction charges.	1000\$/month (per office) + 50% discount for failed QoS / SAP 0.01\$/transaction
Match Maker	Cyber age international video match-making/dating broker, meet your match using video chat conference system	2\$/match + 0.5\$/min
Homework Assistant	Multimedia conference for kids, teacher assisted homework get-together	0.3\$/min
IP Friends & Family	Make cheap telephone/video to predefined set of peers for cheap tariffs	0.05\$/min
Movie channel	Over 100,000 films and TV series streamed on-demand	0.1\$/min
Virtual Room-mate	2-way Circuit TV system for setting up peers so they can see and hear each-other 24 hr/day; for the challenged, home-bound etc.	100\$/month
Virtual Super-Market	Buy groceries without leaving home, controlling a robot in a real super-market.	2\$/pop + 0.4\$/min + articles

# IP Services Billable Parameters

Future pricing structures aren't clear but the following parameters will be their building blocks

Name	Description
<b>Initiator</b>	Billable entry - ID of who initiated the transaction
<b>Terminator</b>	ID of who received the transaction
<b>Application</b>	The Application used during the transaction
<b>CoS</b>	Class of service requested for the transaction (video, voice, web..)
<b>Eff. QoS</b>	Effective QoS as perceived by the parties
<b>Throughput</b>	Average throughput
<b>Bytes In</b>	Bytes received by Initiator
<b>Bytes Out</b>	Bytes received by Terminator
<b>Start</b>	Beginning of Session
<b>End</b>	End of Session
<b>Duration</b>	Duration of Session
<b>Transit</b>	Transit network to through which the session passed
<b>Content</b>	Type of content or tariff



**GENEVA** Geneva Telecom, The Old Granary, Westwick, Cambridge, CB4 5AR

Dr A Tiller  
Dunroamin, The Sycamores, Liverpool, L1 2AA

### Itemised video conferences for account 214726

#### Charges for October 1999

Date	Time	Dialed to	Duration	Quality Requested	Quality Delivered	Cost (£)
02-Oct-99	10:01	Mum	10:23	Standard	Standard	0.63
05-Oct-99	19:23	Sally	04:28	Standard	Standard	0.15
11-Oct-99	09:20	Sally	31:46	Standard	High	1.91
11-Oct-99	22:30	Steve	01:10	High	High	0.17
17-Oct-99	08:23	Nerd	23:40	Standard	Standard	0.61
19-Oct-99	18:01	Mum	1:24:43	Standard	Low	2.54
20-Oct-99	11:07	Grandma	5:23	Standard	Standard	1.73
Conferences not itemised						
Total before discounts						7.74
Quality of service discount						(1.27)
<b>TOTAL</b>						<b>6.47</b>

Source: Geneva Technology

Can VoIP work reliably over the Internet?



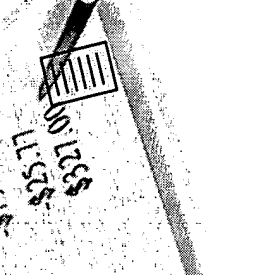
Yes it can! But not for everyone.

XACCOT - Intelligence to right price IP Services

**XACCT** empowers the  
**service providers to offer differentiated and billable services PROFITABLY.**

Internet Access T1	\$2000
QoS Services	Total \$123.97
IP Telephony	\$5.26
Long Distance Voip	\$12.54
Intl Voip	\$24.33
IP Video	\$10.20
Local Video Conf	\$3.33
LD Video Conf	\$10.70
Intl Video Conf	\$14.11
Security, VPN Services	\$100.00
Intranet II (Secured PC)	\$15.83
Secured File Transfer Purchases	\$14.54
*Commission-Demand Purchases	\$15.83
Movies	\$33.21
Games	\$25.71
Financial Data	\$33.21
Total	\$3321.00
Off-peak Discount	
Unavailable QoS Discount	
Total Due	

**Content / service**



## Content / service